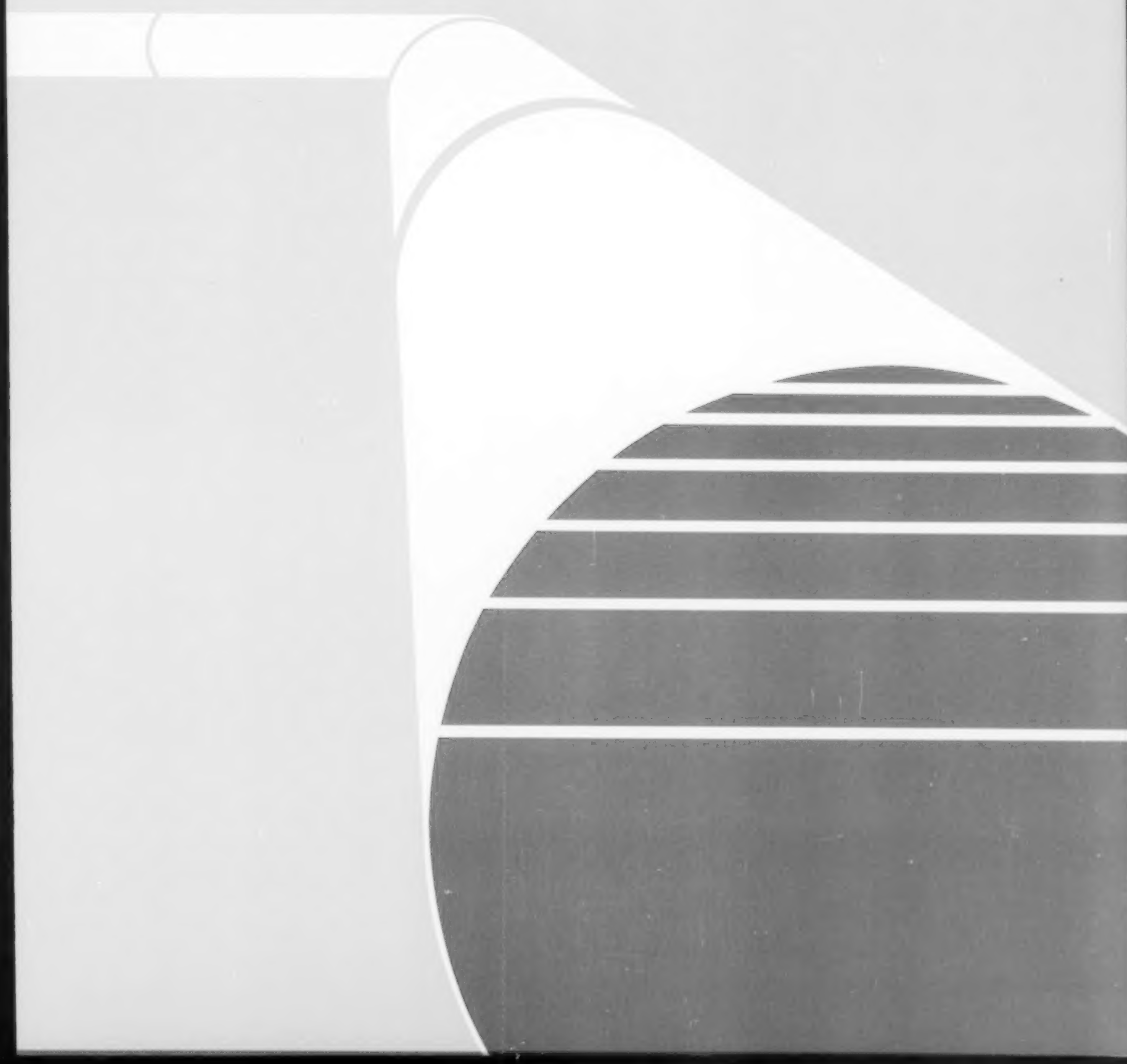
Reclamation

# era

A Water Review Quarterly
Vol. 67 No. 3



Reclamation Era

A Water Review Quarterly
Vol. 67 No. 3

United States
Department of the Interior

James G. Watt, Secretary

Bureau of Reclamation
Robert N. Broadbent
Commissioner

Editor
Carol A. White

Inquiries should be addressed to: Editor, *Reclamation Era,* Bureau of Reclamation, Attn: Code D-140, P.O. Box 25007, Denver Federal Center, Denver, CO 80225-0007.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Subscriptions of four issues are for a one-year period only. Subscription form is available on inside back cover of this issue.

Issued quarterly by the Bureau of Reclamation, United States Department of the Interior, Washington, D.C. 20240. Use of funds for printing this publication approved by the Director, Office of Management and Budget.

The Bureau of Reclamation of the U.S. Department of the Interior is responsible for the development and conservation of the Nation's water resources in the western United States. The Bureau's original purpose "to provide for the reclamation of arid and semiarid lands in the West" today covers a wide range of interrelated functions. These include providing municipal and industrial water supplies; hydroelectric power generation; irrigation water for agriculture; water quality improvement; flood control; river regulation and control; outdoor recreation; and research in atmospheric water management and alternative energy sources, such as wind and solar power. The Bureau of Reclamation is also a primary source of research in the design, construction and development of materials used in water management structures. Bureau programs most frequently are the result of close cooperation with the U.S. Congress, other Federal agencies, States, local governments, academic institutions, water-user organizations, and other concerned groups.

**Table of Contents**



As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

# The New Bureau of Reclamation

**by Garrey E. Carruthers**
**Assistant Secretary of the Interior for Land and Water Resources**

One of my favorite "laws" is the first law of wing-walking. The first law of wing-walking says that you never leave hold of what is supporting you until you have hold of something else. I think it's time for the Bureau of Reclamation to do a little wing-walking; it's time to get hold of a new Bureau and let go of the old.

Photographs by Charles U. Carter, Reclamation's Office of Public Affairs, Washington, D.C.

When we talk about the "old" Bureau versus the "new" Bureau, we need to keep in mind a series of facts:

-States are, and ought to be, in charge of their water resources and the development of those resources.

-There is a need for continued water resources development, both domestically and internationally. Food needs, energy needs, and municipal and industrial water needs will all continue to grow.

-Construction costs for water resource projects will continue to increase.

-The capital for construction will continue to be scarce - especially Federal capital. In fact, we may soon be operating under a balanced budget resolution that would make a significant change in our operations.

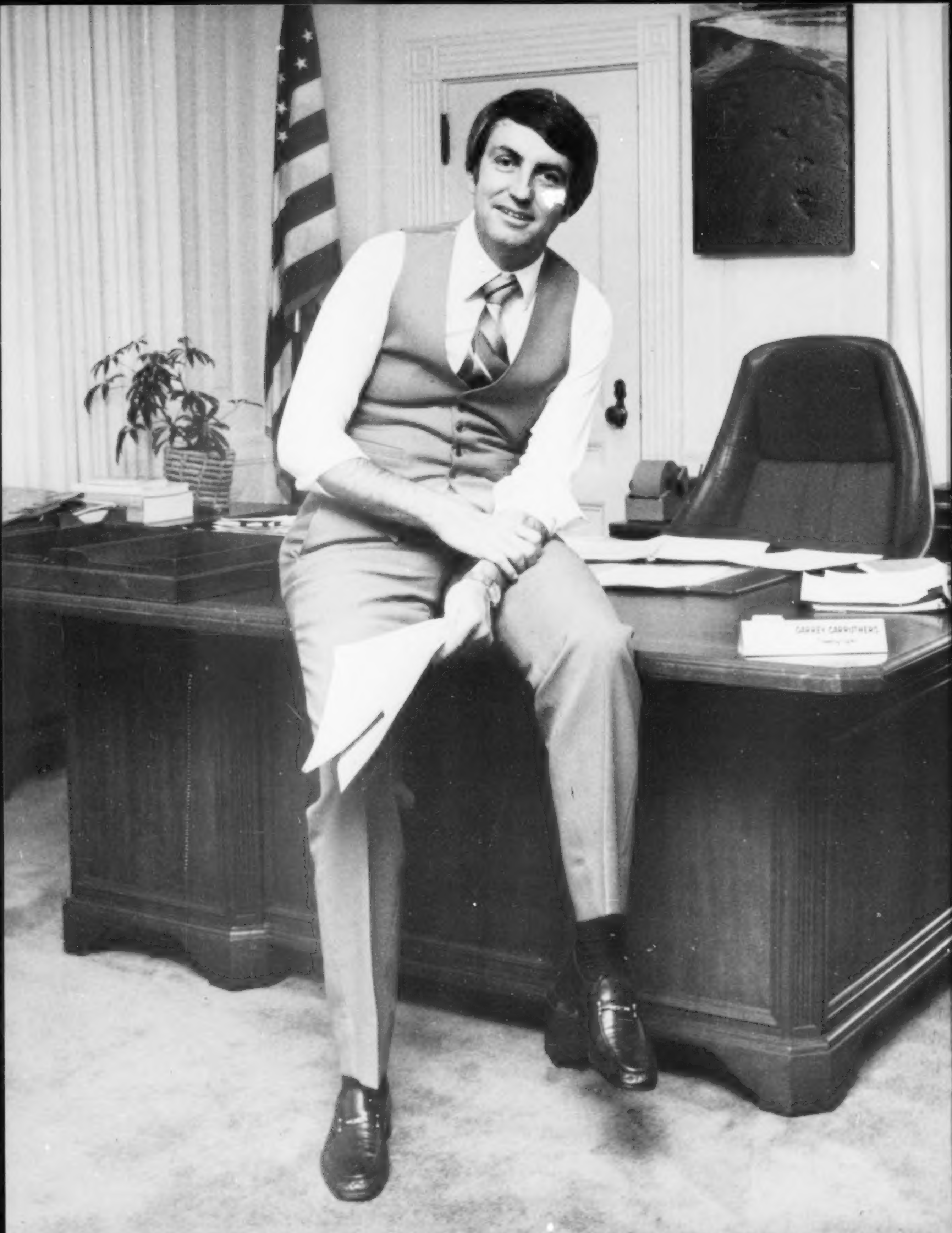
All of this suggests that the Bureau of Reclamation needs to make some changes. We need to move toward a new Bureau of Reclamation.

I think we can actually have a more aggressive Bureau program with less Federal money if we can better manage our existing resources, implement more cost-effective designs, and find new partners. Many changes have already been made to make these goals a reality.

The old Principles and Standards are being replaced by the new Principles and Guidelines which will enhance the flexibility of both decision makers and designers. They will enable the new Bureau of Reclamation to develop projects that meet local needs, rather than simply complying with the rigid Principles and Standards criteria.

*"The Bureau of Reclamation has the greatest expertise in water resources development in the world."*

There has also been a movement by this Administration toward more cost-effective designs and construction schedules. We are going to have to continue to move from "Cadillac" designs to "Ford" and "Chevy" models. All too frequently, the "old" Bureau bent to the interests of a constituency which called for capital-intensive projects with low operation and maintenance



needs. Today, we must design and build projects which, overall, are as cost effective as possible. We cannot be as agreeable as we have been in the past with our constituents' desires to avoid operation and maintenance costs.

We have emphasized the management aspect of Bureau programs, perhaps more so during this Administration than in any past administration. For example, we are trying to reduce the planning process from 17 years to 7 years. The Management by Objectives system that was instituted by Secretary Watt and Commissioner Broadbent is another example of trying to manage the resources we have more cost effectively.

*"Reclamation must begin investigating its current untapped potential."*

The Administration has also indicated that it wants to have some new water project construction starts. Soon the President will be announcing the Bureau of Reclamation's new construction starts. Cost-sharing agreements will be an important aspect of all the new starts. Cost sharing will still include some Federal subsidy, some cost recovery, and some market-oriented activities. Essentially, the cost-sharing proposal suggests

nothing more than that we need new partners, be they non-Federal governmental entities or private sector organizations.

The prospect of new partners creates some of the most exciting challenges for the future of the Bureau of Reclamation. In those cases where we ask for 100 percent cost sharing, the new Bureau may often find itself serving as a consultant, a quick-turn-around design unit, rather than as a construction agency. Of course, where there is Federal involvement in financing, the Bureau will continue to serve as a contractor and construction engineer.

If we are to have new partners, they will want to participate much more than they have in the past. New partners are going to want to share in planning and management decisions. The new Bureau must design management and planning systems that allow participation by any one of a number of partners.

New partners will also need help in preparing their financial portfolios. In many cases, we deal with conservancy districts and communities. They really do not have the background to put together the necessary financial packages. The new Bureau will need a much greater awareness, perhaps even a new division, of creative financing. We will need to advise these groups on assembling the proper financial portfolio required to launch a new water project.

The Bureau of Reclamation has the greatest expertise in water resources development in the world. We should pursue offering that expertise abroad, as the services we offer are needed throughout the world.

The Bureau's involvement in foreign development is in the best interests of our Government. It is also in the best interests of the governments in developing countries. In terms of world peace, there is nothing that would be as beneficial as having economic development, and food and energy production more evenly distributed.

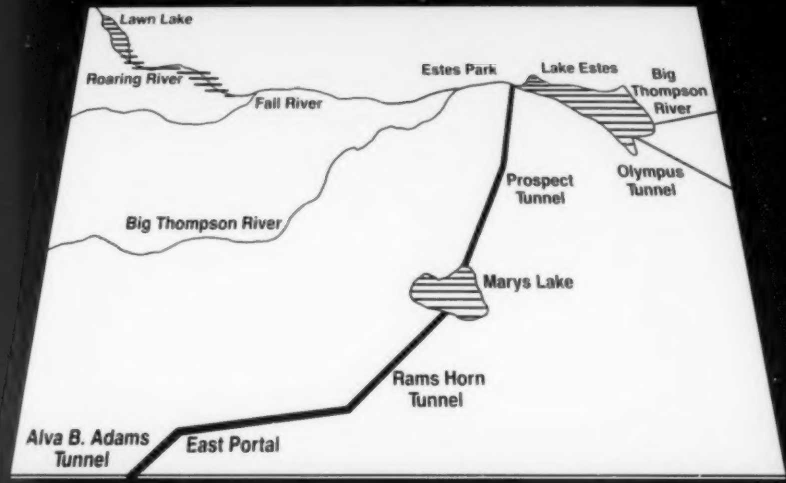
In the new Bureau, we will have to find ways of participating in these international ventures without extensive personnel reallocations. The Bureau must become an overseer, contracting and assigning tasks to other bureaus, agencies and the private sector.

*"The new Bureau . . . will discover that its horizons are unlimited."*

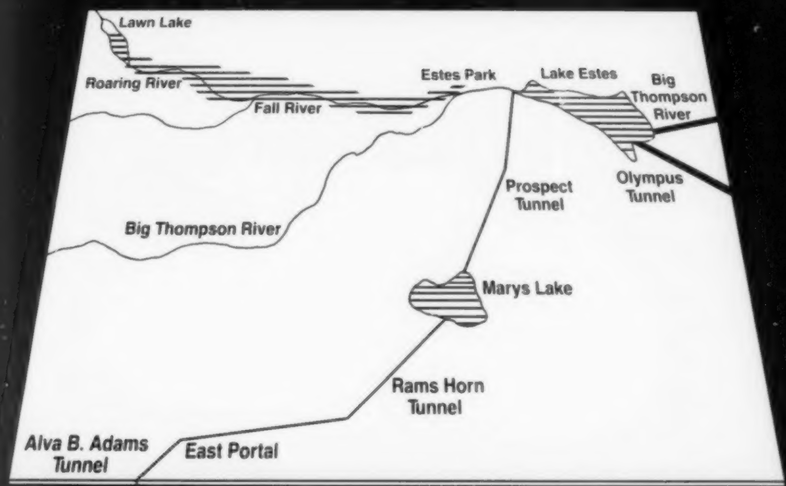
These are some of the challenges which face the new Bureau of Reclamation. They are exciting ones. If I already knew all of the answers, there would already be a new Bureau. But I don't know all of the answers, which is why I am asking the Bureau to look down the road a bit, to find a different work environment than that to which it has become accustomed.

In reality, this has to happen. The Bureau of Reclamation must begin investigating its current untapped potential in new and often unique areas. And, as the move is made to take hold of the new Bureau, it will discover that its horizons are unlimited.

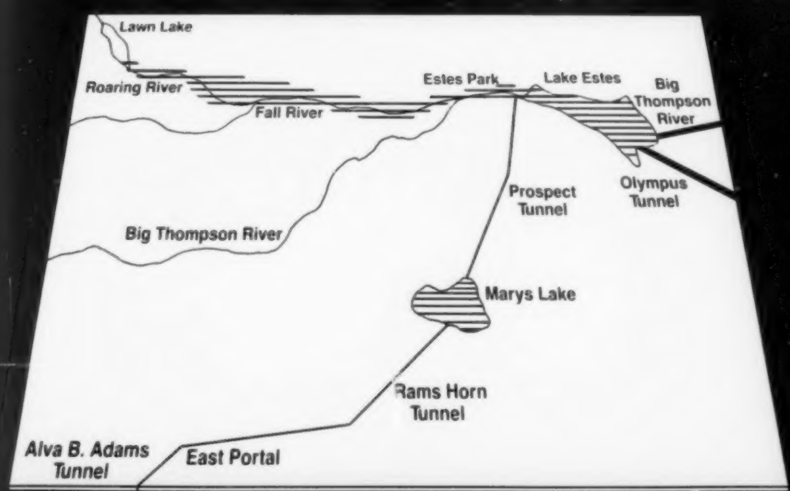
**July 15 — 6:00 to 7:00 a.m.**
Lawn Lake Dam fails near its center. Water from West Slope reservoirs is coming through the Alva B. Adams Tunnel, passing through Marys Lake, and entering Lake Estes at a rate of 670 cubic feet per second.




**July 15 — 7:12 a.m. to 8:30 a.m.**
Reclamation shuts off the water coming through the Adams Tunnel and Marys Lake into Lake Estes, and begins releasing water through Olympus Tunnel and into the Big Thompson River. Floorwaters enter downtown Estes Park.




**July 15 — 8:47 a.m. to 1:00 p.m.**
Floodwaters reach Lake Estes, cresting at nearly 6,000 cubic feet per second. Lake Estes captures more than 228 million gallons of floodwater, and rises a total of two feet. Lake Estes stablizes and begins receding slowly.



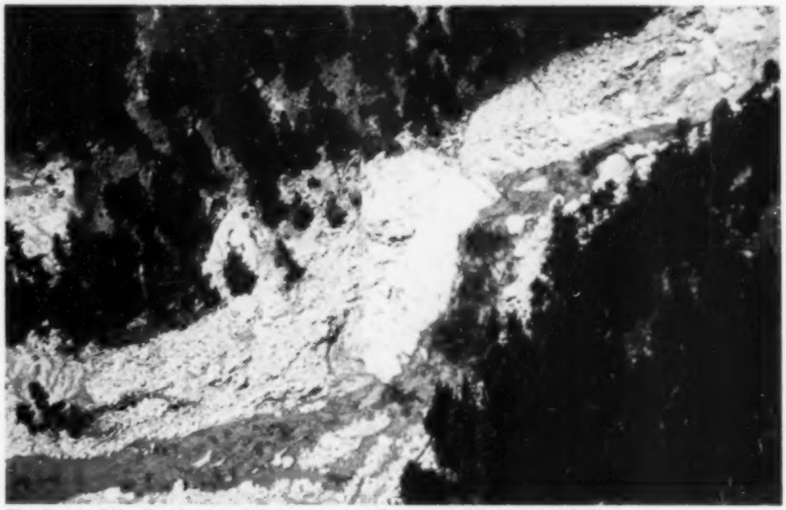
# Olympus Dam, Lake Estes: Turning Back a Flood

**by Kathy House**

**Olympus Dam, Lake Estes**
**July 15, 1982**
***6:00 a.m.***
Lawn Lake Dam, an 80-year-old structure maintained by Farmers Irrigation and Reservoir Company and located within the Rocky Mountain National Park about 13 miles northwest of Estes Park, Colorado, fails near its center. The breach in the dam parallels the outlet works.

Prior to the dam failure Lawn Lake Reservoir, a natural lake whose capacity was expanded, is full to the lip of the spillway. After the break, some of the water remains in the depression of the natural lake, but most rushes down the Roaring River.

Lawn Lake Dam after the failure.



The force of the floodwaters left scars down the mountains that reached bedrock in some places.

Kathy House is a Public Information Specialist in Reclamation's Lower Missouri Regional Office, headquartered in Denver, Colorado.

Photography by Jim Todd, regional photographer in Reclamation's Lower Missouri Region, headquartered in Denver, Colorado.

As the water surges downriver, it takes out most of the trees, grass and other vegetation in its path. Even the soil is scoured away, so that nothing is left but a great scar through the timber that reaches to bedrock in many places. All of this water and debris moves into Horseshoe Park, also within the Rocky Mountain National Park.

Once inside Horseshoe Park, much of the heavy debris, such as timber and rock, settles out. The floodwaters then enter the Fall River, destroying Highway 34 bridge.

The water courses on eastward, destroying Cascade Dam and Reservoir, and severely damaging the small Estes Park hydroelectric powerplant and other facilities.

Floodwaters head straight for the town of Estes Park.

***7:00 a.m.***
Lake Estes, part of Reclamation's Colorado-Big Thompson Project, is at an elevation of 7,471 feet — four feet below the normal maximum water surface level of 7,475 feet.

Water from West Slope reservoirs is coming through the Alva B. Adams Tunnel at the rate of 550 cubic feet per second, passing through Marys Lake, and entering Lake Estes at a rate of 670 cubic feet per second. Water is being released from Lake Estes into the foothills power system by way of Olympus Tunnel at a rate of 550 cubic feet per second.


Roads and bridges were swept away by the force of the water.


The floodwaters surged down Estes Park's main street, Elkhorn Avenue.


Floodwaters five feet deep surged through Estes Park, overturning vehicles and wreaking havoc.

Water from the Big Thompson River is also entering Lake Estes at a rate of 420 cubic feet per second and is being released at the same rate through the Big Thompson Canyon.

***7:12 a.m.***
Reclamation's Loveland Control Center at the South Platte River Projects Office in Loveland, Colorado, receives notice from a Bureau employee at Estes Powerplant that Lawn Lake Dam has failed. This report is confirmed within minutes by Larimer County Sheriff Jim Black.

Knowing the size of Lawn Lake Reservoir, Reclamation experts act to minimize further flood damage. They realize that, with proper water releases, Lake Estes will be able to contain the flood. Reclamation's immediate actions are to shut off the water coming into Lake Estes from West Slope reservoirs. At the same time, Reclamation increases the amount of water being released through Olympus Tunnel to 575 cubic feet per second (maximum

Estes Park residents were faced with the cleanup.

carrying capacity of that facility), and maintains releases into the Big Thompson River at a rate of 420 cubic feet per second.

South Platte River Projects manager Bob Berling then makes special assignments to key staff people. He decides to stay at project headquarters to personally coordinate activities, to respond to news media and other inquiries, and to give progress reports to Lower Missouri Regional Director Bill Martin in Denver.

Berling sends Mike Deihl, East Slope Area manager, to Estes Park to direct the onsite water operations at Olympus Dam. The Loveland Control Center, under the direction of Tom Boston, is the central focal point for up-to-the-minute information on flows, reservoir water surface levels, and control of waterways and powerplants. Personnel at Estes Powerplant are also monitoring Lake Estes inflow and water surface levels.

The water scheduling division under Robert Bellamy monitors water levels received from Loveland Control Center and determines what releases should be made.

Fortunately, a helicopter belonging to the Western Area Power Administration is at the project office that day and Western makes the helicopter and pilot available for Reclamation's use. Zenas Blevins, chief of the project office's water and lands operations division, is assigned to take the first trip over the flood area to assess the damage and make his observations available to the staff. He is also told to write a brief report on the situation before the day is out in order to meet Reclamation's 24-hour written report requirement.

Berling assigns Ken Vick, chief of the project's power division, to assist him in directing and coordinating the overall operation and in handling the many calls from Senators, Congressmen, news media representatives, and others.

***8:30 a.m.*** (time approximate)
Floodwaters enter downtown Estes Park. The river is so confined through downtown that most of the water goes right down the main street, Elkhorn Avenue. At one point the water is approximately five feet deep - and flowing swiftly toward Lake Estes.

***8:47 a.m.***
Floodwaters reach Lake Estes. As the water comes up, the water scheduling division begins computing the flow into Lake Estes every five minutes. They monitor the changing reservoir elevation on their computerized display terminals. The elevation changes are confirmed by workers at Olympus Dam who are making tape measurements. Using these measurements and the outflow rate, they are able to compute the amount of water flowing into the reservoir.

***9:15 a.m.***
Entering Lake Estes the floodwaters crest at nearly 6,000 cubic feet per second. Lake Estes ultimately captures nearly 700 acre-feet of water — more than 228 million gallons — and an enormous amount of debris. The reservoir rises a total of two feet - from an elevation of 7,471 feet up to 7,473 feet.

***9:30 a.m.***
Reservoir inflow begins receding slowly from 6,000 cubic feet per second down to 1,000 cubic feet per second shortly after noon. With releases to Olympus Tunnel at 575 cubic feet per second and releases to the Big Thompson River at 420 cubic feet per second, outflow is roughly equivalent to inflow.

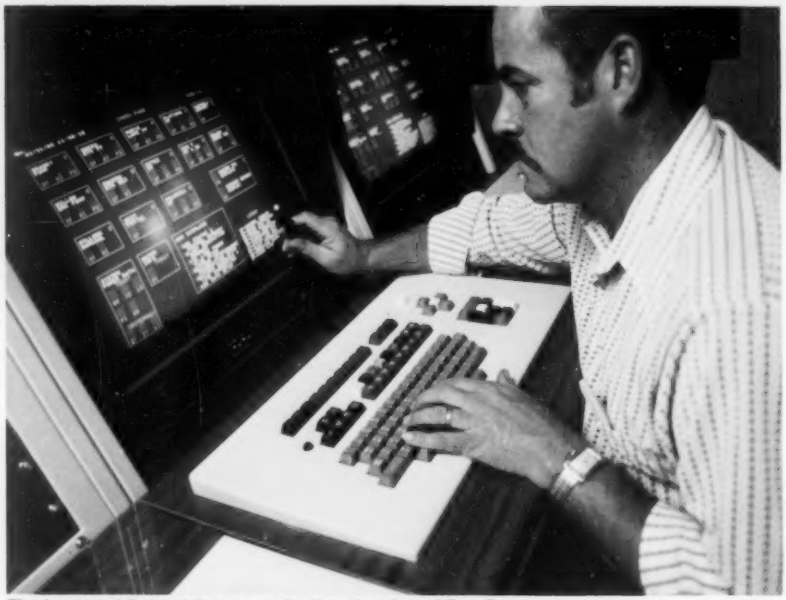
***1:00 p.m.***
The reservoir water surface levels off at an elevation of 7,473 feet. Though rumors spread during the morning that Olympus Dam might fail, these are completely false. The reservoir could actually have risen another two feet in final elevation before reaching its maximum water surface level.

With floodwaters safely captured and being released in a controlled flow downstream, the new crisis becomes handling the debris. The debris causes great concern because floating propane tanks and other hazardous items have entered the reservoir.

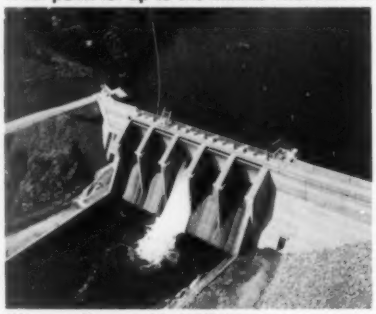
Fortunately, most of the debris lodges near the south shore of the reservoir, near the recreation area and away from the dam's radial gates. This allows the gates to be operated in a normal manner.

The concessionaire at Lake Estes assists by providing boats and workers to help keep debris corralled near the shoreline. Mike Deihl and his crew remain at the gates, outlet and intake structures until 8 p.m. in order to keep debris away from the Olympus Tunnel intake and from the radial gates of Olympus Dam. During the next two days, Reclamation personnel remove as much debris as possible from these areas and the beach.

**July 16**
Water quality has now become a major problem. In addition to vegetation, timber, soil, gravel and manmade objects, raw sewage from the Estes Park city sewer plant on the north shore of Lake Estes is entering the reservoir. The Upper Thompson Sanitation District Sewer Plant below Olympus Dam also is discharging raw sewage into the river because the heavy mud and sediment flows have completely jammed the plant's system.



**The Loveland Control Center, under the direction of Tom Boston, is the central focal point for up-to-the minute information.**



**Olympus Dam and Lake Estes.**

The South Platte River Projects Office advises domestic water users along the Big Thompson River, in the Pinewood and Flatiron areas, in the city of Loveland, and along the Charles Hansen Feeder Canal to take extra precautions, such as increasing chlorination and boiling the water before using it.

Due to releases downstream and through the Olympus Tunnel, the reservoir level of Lake Estes has now dropped to about 7,469 feet. Maintaining this relatively low level in the reservoir helps keep debris hung up on the shoreline, where it can be removed.

The project continues releasing water downstream at a rate of 420 cubic feet per second, but cuts off further releases through Olympus Tunnel. This reduces the spread of polluted waters.

Project irrigation requirements on the Big Thompson River are met by diverting Adams Tunnel water directly into the river at Lake Estes. This release of clean West Slope water into the river helps to improve the water quality of the Big Thompson River.

Because of a shortage of workers and the need to respond quickly, Reclamation managers decide to contract out the Lake Estes cleanup job.

Reclamation employees, Elmer Haight of the Division of Design and Construction, and Verdell Howard and Jay Dreibelbis of the Division of Procurement and Contracts, arrive at the Estes Powerplant from the Regional Office in Denver. In a meeting with project officials, Jim Barnes and Zenas Blevins, they quickly prepare and issue a statement of work for the reservoir cleanup. Three local contractors submit contract proposals during the next few hours.

Aerial view of cleanup on Lake Estes.

Lake Estes looks picturesque and tranquil, back to normal after the flood cleanup.

After evaluating the proposals, Howard and Dreibelbis hold discussions with two of the bidders, get their best and final offers, and award a contract about 9:00 p.m.

The contract is awarded to Donkehn Construction Company of Fort Collins in the amount of $36,717. The firm agrees to remove all manmade objects and anything over 18 inches long or 2 inches in diameter that is within 6 feet of shore. The contractor is to begin work July 19 and complete the job by July 26.

**July 20**
Water quality within the project system is improved by special releases from Carter Lake. High-quality water from Carter Lake, which was unaffected by the flood, is used to dilute and flush out sediment-laden waters elsewhere in the project.

Reclamation arranges to make delivery of some of the floodwaters, captured in Lake Estes to the Farmers Irrigation and Reservoir Company. By an exchange arrangement with the Greeley-Loveland Irrigation Company, the Farmers Irrigation and Reservoir Company receives the water lost when its dam was destroyed.

**July 29**
A second contract for cleanup of Lake Estes is awarded to Varra Company, Inc., in the amount of $7,905. The contractor agrees to remove a large deposit of river debris including silt, sand, gravel and rock, which washed into the Big Thompson River inlet area of Lake Estes during the flood. The contractor is to use the debris to enlarge an existing levee adjacent to the inlet area.

Work for this contract is successfully completed by August 2, 1982.

**August 3**
Less than 20 days after the Lawn Lake Dam failure, a major cleanup job has been completed. Reclamation's Olympus Dam and Lake Estes are fully operational again, ready to resume their normal functions as part of the Colorado-Big Thompson Project.

# Another Culture... Another Time

**by Curtis M. Groom**

**January 20** — I met with Jerry Bowles, head of the Division of Design's Concrete Dams Section, and Dan Macura of the Division of Foreign Activities. Jerry and I received our last-minute instructions and finalized arrangements for shipment of our underwater audio-video equipment. We left Denver around noon, changed planes in New York and again in Paris, arriving nearly 26 hours later in Cairo, Egypt.

The Sphinx amid the pyramids.

Curtis M. Groom is a Marine Operations Specialist, a master diving instructor and an expert in underwater engineering inspections. He is based in the Lower Colorado Region, Boulder City, Nevada.

Photography by Curtis M. Groom.

**January 21** — At Cairo we were met by representatives from the Ministry of Irrigation and the Agency for International Development. Everything went well until Customs spotted the padlocked containers of TV equipment. They asked what was inside. I opened a cut-off barrel containing 600 feet of television umbilical cable. The Customs officials also asked to see what was in the large red fiberglass container holding the TV monitoring and communication systems.

By this time, about 200 people crowded around to see the television. The Customs officials wanted me to put a tape in the videorecorder. I put in a film of underwater engineering inspections of a dam in Colorado. Everyone was astonished and pleased that such equipment had been brought to Egypt and that Egyptian technicians would be trained to operate it.

After clearing Customs, we were driven to the U.S. Embassy Guest House in Cairo.

The boat used by our diver was pulled along by hand.

The camel with the rider is known as a "car," while the camel with a load only is known as a "truck."

**January 22** — After breakfast, we met with the Minister of Irrigation and his staff, representatives from AID and the World Bank. The Ministry representative said the most critical barrage (Egyptian term for "dam") was the Isna Dam near Luxor. We requested at least three divers to meet safety requirements and to handle the equipment properly. The TV system operation was discussed. The local power supply is very uneven with great fluctuations in power. We explained we would encounter severe problems and perhaps even permanent damage to the TV system, unless we had a regulating-type transformer to control voltage. They agreed to provide a transformer and adapter plugs.

Isna Dam is approximately one-half mile across.

This diver was sent from Alexandria to replace the first diver who became ill.

**January 23** — At 5 a.m. we checked out of the guest house, and were driven to the airport for our flight to Luxor at 7 a.m.

From Luxor, we traveled by car to the Irrigation Office at Isna. There we met the head of the Barrage Department who arranged a preliminary look at the barrage and the cleanup and repair work at the lock. It was helpful to see the lock completely dewatered. Bulkheads had been installed upstream and downstream.

Completed in 1908, this barrage is approximately 35 feet high from its 12-foot base to the roadway on top. It is built of blocks of various types of sandstone with a base of granite interlaid, very substantial for this type construction.

While in Isna we stayed at the Ministry of Irrigation Guest House, a magnificent structure of hand-carved sandstone, built between 1902 and 1908. The only thing it lacked was adequate hot water. Only one bathroom had hot water and it was heated by a butane tank you lit yourself.

**January 24** — Most of the day was spent in the Isna Barrage Office and area, discussing engineering problems and construction techniques, and reviewing engineering drawings and results of various tests.

The divers were scheduled to begin today. However, they did not arrive and we were told it might be another day or two before they could get to Isna.

The barrage appeared to be in good condition, but indications from Egyptian officials were that there were problems underwater. We still did not understand what the existing problems were. Egyptian interpreters were fairly fluent in English; but there were certain things that they could not fully explain to our satisfaction.

There was a lot of traffic on the barrage, but not the type we expected. Burros carried bales of freshly cut alfalfa. With a bale on each side of the burro and a person riding, it was called a "donkey car." If a third bale was put on top and the person was not riding, then it was called a "donkey truck." The same was true with camels and oxen.

By this time core drilling was being done at the barrage. We observed their drilling techniques and inspected core


MEDITERRANEAN SEA
Alexandria
Suez Canal
Cairo
Giza
SINAI PENINSULA
EGYPT
Nile River
Thebes
Valley of the Kings
Luxor
Isna
RED SEA
North
Aswan

**Sailboats are popular on the Nile, however, most tourists use the motorized sightseeing boats in the background.**

samples. Egyptian core drilling techniques and equipment are modern, but not as advanced as American technology and equipment.

**January 26** — Again after closer examination of Isna Barrage there appeared to be no distress. This surprised us because very large motorized trucks and heavy traffic were crossing the structure. There were no indications of movement or vibration.

A little before noon, a diver arrived. We were told we would have to conduct the diving inspections with one man because he was the only diver available. This concerned me because of the safety factor.

In the afternoon, we set up the television equipment and explained the full operation to the diver. I explained to our interpreter that the diver would have to lower his voice, speak slowly and clearly because it would be difficult to understand him over the bubbles being released from his breathing apparatus.

The diver familiarized himself with the gear off the side of the dive boat. That boat was quite something: a big old steel boat half filled with dirt and logs and no motor. Instead, 15 people with ropes walked along the dam and pulled it.

I was very concerned with not having another diver available for rescue, should the need arise. However, from the top of the barrage where we were standing, it was about 30 feet to the surface of the water and the depth was about 15 feet. So I felt I could make a rescue if need be. My fears did not materialize.

We began filming with the diver going into vent 2. However, he failed to explain where he was and what he was filming, which made interpretation of the film difficult.

**January 27** — We began the underwater examination of all the vents. During the first dive, the power failed and we had to go to battery power. The pictures and recordings taken during this period were adequate but they were not good. It took 2 hour-long tapes for the first two dives. We needed to speed up the operation or we would not be able to film the entire structure.

During the afternoon the diver got sick and could not continue. He was shivering uncontrollably, a strong symptom of oncoming hypothermia. We stopped the operation. I suggested the diver be taken to a doctor for a complete physical examination and not be allowed to continue until he had been given a clean bill of health.

In the evening we returned to our quarters to work on paperwork and to review videotapes. Jerry and I decided to show these tapes to the diving crew. This proved helpful. After they saw where mistakes had been made, we explained how they could be corrected.

**January 28** — We learned that the Director General of Grand Barrages had been trying to obtain two additional divers for us. However, it was the season for repairs and all divers were involved in repairing the locks.

We continued to examine drill cores and to document our work through photographs.

After reviewing the available data, we determined there did not appear to be enough erosion to be of major concern, with the exception of the lower gate where the diver could not get close enough to film because of the current.

The only concern at this time was the quality of concrete in the piers. There had been significant repair work done.

That afternoon we left by car for Aswan, a distance of about 150 kilometers. When we arrived we were invited to stay for the night by the retired Minister of Irrigation. He is about 80 and is very knowledgeable. He had been in charge of construction of the Aswan High Dam. We were very pleased to have the opportunity to visit with him.

**Paintings and petroglyphs on the walls of King Tut's tomb.**

**January 29** — We breakfasted with the retired Minister. He said when construction began on the High Dam in 1960, skilled labor was very scarce. He started with 500 people and 14 training centers. Before construction was complete they trained 14,000 skilled laborers, such as welders, mechanics and carpenters. At the peak construction period, there were about 35,000 workers.

We then visited a soil laboratory, looked at some drilling samples from the Isna Dam and received a good explanation of the materials used in the piers. The mortar in the old part of the dam was crushed brick, clay and lime. This mixture was used for centuries, is very light and stands up well in water. After our visit to the laboratory, we returned to Isna.

**January 30** — A diver arrived in Isna from Alexandria. We instructed him on equipment use and procedure. The new diver was given an opportunity to become familiar with the equipment. He was shown some of the previous videotapes and errors were pointed out in order to improve the footage quality. This diver was more experienced, and was also a mechanical engineer.

**The locks were dewatered which allowed a good look at the construction.**

**The Ministry of Irrigation Guest House in Isna is a magnificent structure built of sandstone blocks.**

**Residence of retired Minister of Irrigation at Aswan is similar to residences of the well-to-do in Egypt.**

The vents that were thought to contain erosion and holes were given special attention. But, the tapes showed no holes, only slight erosion existed between the granite blocks and the floors.

**January 31** — We went for a walk on the lock. The workmen were moving the bulkheads with a 50-ton-capacity floating crane. Everyone heard a thumping noise and vibration was noticed near the right end of the dam. After an inspection, a vortex (whirlpool) was noticed at vent 116, and the lower gate was closed. We would conduct a thorough examination in the morning.

**February 1** — We found another vortex near vent 118. The diver was able to inspect both vents and to get pictures of the gates and the floor. No erosion or other problems could be seen.

At our insistence one of the irrigation people used a long measuring rod to do a sounding job on the upstream side of the gate. There was no erosion under the gate. The elevation of the waterline was the same on the rod all the way across. It was determined that it was the flow velocity that started the vortex rather than a hole caused by erosion.

**February 2** — We left Isna at 9 a.m. and arrived in Cairo at 11 p.m. Again we stayed at the U.S. Embassy Guest House. An agenda was prepared for our meeting with representatives of AID, the Ministry of Irrigation and the Director General of Grand Barrages.

**February 3** — We discussed the findings at Isna. Everyone seemed very pleased with the findings, and with the audio-video tapes. We discussed the possibility of leaving the video equipment for the Egyptians to use in their dam safety program. They were most pleased because of the work training accomplished and necessary video equipment acquired.

**February 4** — We met with the Minister of Irrigation and discussed our trip and findings.

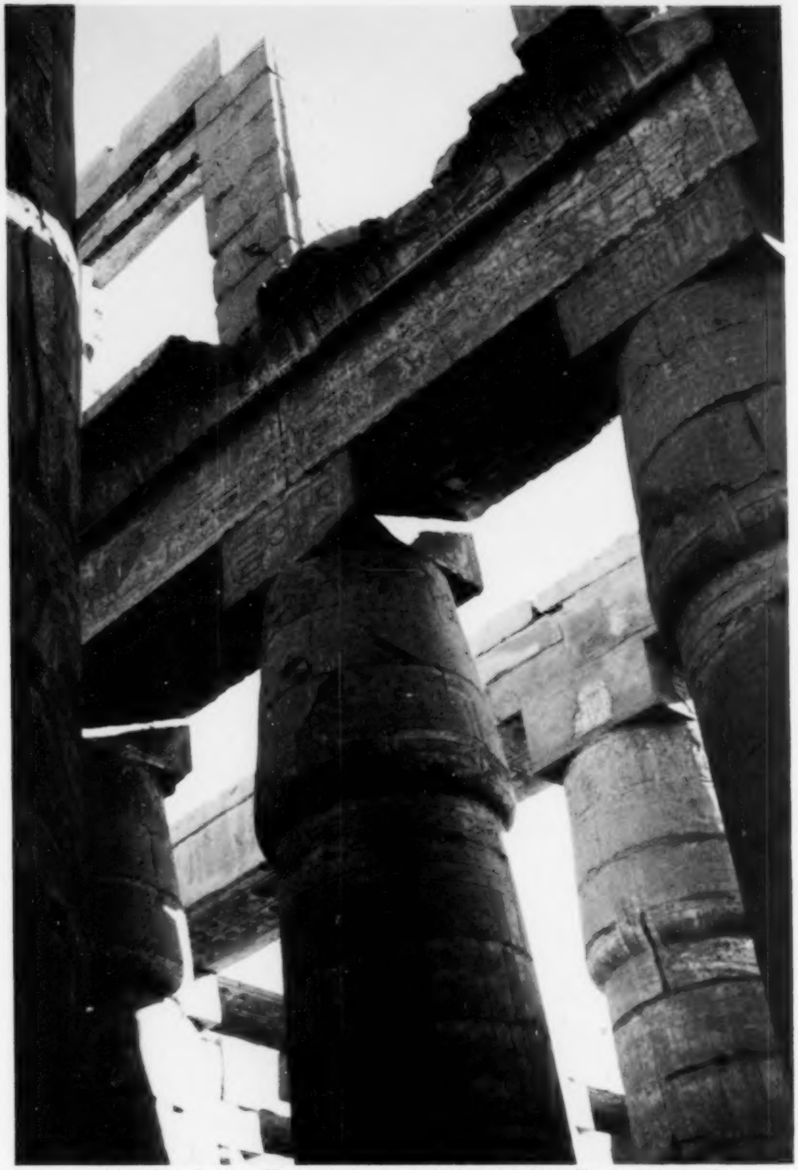
**February 5** — The presentation to the Minister of Irrigation and Ministry aides was a success with our interpreter filling in when necessary. The videotape of the vents where the vortexes formed seemed to be what interested them most.

**Aswan Dam is one-half-mile in length.**

After the presentation, we met informally with the Minister. He discussed plans for receiving up-to-date information on drilling techniques and equipment that would be available.

**February 6** — We returned to the United States.

Jerry and I felt that the entire trip was very successful, both from a professional and personal standpoint. When technical difficulties prevented us from accomplishing what had been scheduled, guides escorted us to all the local points of interest, explaining in detail their history and culture. The Egyptians' hospitality made this an outstanding trip and a pleasure we will not forget.



**Columns at the Karnak ruins. The columns were designed to be self-supporting and interlocking. They were cut so perfectly that no mortar or cement was used.**

*Editor's Note: Curtis M. Groom, together with Gerald Bowles, a design engineer and head of the Concrete Dams Section at the Engineering and Research Center in Denver, Colorado, was assigned to work on a special dam safety project at the request of the Egyptian Ministry of Irrigation. The article is based on Groom's tape-recorded "diary" of the assignment. It illustrates the challenges presented by language and cultural differences faced by Reclamation personnel on foreign details.*

*Both Groom and Bowles wrote detailed technical trip reports. The reports cover the underwater studies conducted and the training of Egyptian personnel.*

*Although it was concluded that the underwater portion of the Isna Barrage was in good condition, the results obtained from this underwater investigation prompted the Egyptian Ministry of Irrigation to purchase the equipment. Plans were then prepared to conduct similar investigations on the aging control structures downstream. At this time, it is not known if these investigations were conducted.*

Our activities attracted much attention.

The marketplace in Luxor has everything from buckets, to jewelry and trinkets, to food.

# A Joint Effort: Frenchman-Cambridge Rehabilitation and Betterment

**by Kathy House**

More than 650 million gallons of water saved annually. An 8-to 10-percent increase in farm water — use efficiency. Faster delivery of water ordered by irrigators. Lower operation and maintenance costs.

These benefits and others are the result of another successful Bureau of Reclamation program under the Rehabilitation and Betterment Act - replacement of more than 50 miles of open ditch canals with buried pipe on the Frenchman-Cambridge Irrigation District in Nebraska.

Kathy House is a Public Information Specialist in Reclamation's Lower Missouri Regional Office, headquartered in Denver, Colorado.

Photography by Frenchman-Cambridge Irrigation District.

**More than 50 miles of buried pipe was laid on the Frenchman-Cambridge Irrigation District in Nebraska.**

The project is unique because the district elected to do the work with its own employees using a $4.4 million loan under the Rehabilitation and Betterment Program for funding. The loan will be repaid without interest, by a per-acre assessment on farms within the district.

The Frenchman-Cambridge Irrigation District project area, approximately 90 miles long and 5 miles wide, is located in southwestern Nebraska along the Republican River. The district provides service to 45,000 acres, or about two-thirds of the irrigable acreage served by the Frenchman-Cambridge District. It is currently responsible for the operation and maintenance of three diversion dams, 157 miles of canals, 113 miles of laterals, and 158 miles of surface and subsurface drains.

To begin the Rehabilitation and Betterment Program, the district purchased the necessary equipment, hired and trained an additional construction crew of five full-time and eight part-time employees. A consultant was hired to do the engineering. Bob Kutz, project manager of Reclamation's Nebraska-Kansas Projects Office gives credit for the success

**The project is unique because the irrigation district used its own employees to do the work.**

of the program to the irrigation district and especially to the organizational talents of Vernon Laverack, district superintendent.

District water users, who receive water from Hugh Butler Lake, Harry Strunk Lake, and Swanson Lake, explored the idea of using buried pipe in the early 1960s when commercial availability of low-cost plastic pipe made the project economically feasible.

The district began burying pipe in 1968 under a water user participation program. Farmers paid for the materials and district employees did the work. Despite some unexpected problems and mistakes, district workers completed installation of 12 miles of buried pressure laterals by 1977.

The benefits of having an underground system became apparent to the district's management through this cooperative program. It also became obvious that the benefits of a district-wide system improvement would be long delayed, possibly never achieved, through a piecemeal process. To carry out the program more effectively, the district requested financial assistance under the Rehabilitation and Betterment Act of 1966. Reclamation's Lower Missouri Region conducted a feasibility study on the project which led to the loan of $4.4 million to the district in 1977.

Laverack, the district's manager, chuckled as he recalled the main reason the district was interested in a buried pipe system. "We started this program before conservation was a big byword," he said. "At that time, we figured the operation and maintenance costs on open ditch laterals were about $350 a mile and our main concern was economics. Savings of water was low on the list. Now the economy thing is clear in the back seat - the important thing is the water."

The new system does provide water conservation — about 650 million gallons annually, according to one estimate. Closed pipes do not lose water to seepage or evaporation, and allow farmers to use gated pipe instead of open ditches with siphon tubes.

Gated pipe has slotted openings or gates, that can be opened varied amounts to discharge a specific amount of water. Gated pipe also is faster and easier to set up than siphon tubes. Most open-ditch canal and lateral systems do not have enough "head" or water pressure to allow use of gated pipe.

Laverack said one farmer told him that gated pipe was so much easier to use that "it makes the difference between having a hired man or not."

"When we first started the program, the biggest share of farmers had siphon tubes. Only two didn't switch to gated pipe the first year after we buried the first lateral system," Laverack said.

Reduced cost and time to operate and maintain the project were other big benefits of buried pipe laterals. As the system was buried, other changes were made to make deliveries easier and more convenient.

One of the most helpful changes was moving several turnouts, or metered taps for releasing water, to a central location. Now a ditch rider can control water for three or four farms from one location, rather than traveling to a different location to release water for each one.

In addition, maintenance work on open ditches - cleaning, ditching, spraying and mowing - is now unnecessary.

Laverack said that now farmers can order water closer to the day they need it, not several days in advance, thus providing more flexibility for the users.

**Maintenance work on open ditches included cleaning, spraying and mowing.**

**Maintenance on open ditches is now unnecessary.**

The extensive underground delivery system would not have been possible at such a low cost if it were not for the fact that natural pressure sends the water through the pipe. By a fortunate coincidence, major canals and laterals in the Frenchman-Cambridge District were built at a higher elevation than the smaller laterals. So natural "head," or pressure of water traveling from a higher to a lower elevation, pushes the water through the underground pipe, making irrigation pumping power charges unnecessary.

"The project works almost as if it had been originally designed for buried pipe delivery," Kutz said.

Laterals can be buried in a straight line, not routed along property or field boundaries.

A ditch rider can control water for more than one farm from a central location.

Other advantages of the underground system include the fact that areas overlying buried laterals can now be farmed, laterals can be buried in a straight line (not routed along property lines or field boundaries), and fields are no longer split by laterals.

Some rights-of-way have been returned to previous owners, while others have been set aside for wildlife. Fourteen plots, a total of 76 acres, have been turned over to the State for management as wildlife habitat areas. This compensated for grass that was lost as wildlife habitat when ditch banks and associated areas returned to cropland.

Just over 80 percent of the conversion was completed by June 1982 at a cost of $3,535,466. The district, with support from Reclamation's Lower Missouri Region, is requesting an additional $1.1 million to bury the rest of the laterals that can be converted. The district has agreed to repay the entire $5.5 million sooner than the original $4.4 million was due.

Seventy-six acres have been returned to the State as wildlife habitat.

Some laterals cannot be covered because they are on such a flat grade or are so large that pressure delivery is not possible. So some irrigators will not experience direct benefits of pressured deliveries or restored land.

However, district personnel note that all irrigators will definitely benefit from overall water conservation and reduced operation and maintenance costs.

Kutz summed up the reason for the district's successful program: "This is an example of what happens when those in a district start to think in terms of what is best for the district. If they stick together as a district, they will be able to solve their problems."

Specialists discuss problems and solutions of water conservation and development.

# SUBSCRIBE NOW!

## $11.00 PER YEAR

($13.50 for foreign mailing)
Single copies available for $3.50 ($4.40 for foreign mailing). Order from: Bureau of Reclamation, Public Affairs Center, Code D-140, PO Box 25007, Denver Federal Center, Denver, CO 80225-0007.

Reclamation Era, the official publication of the Bureau of Reclamation, U.S. Department of the Interior, is printed quarterly.


Send Subscription to:

PLEASE PRINT

### SUBSCRIPTION ORDER FORM

Enter my subscription to *Reclamation Era* for one year @ $11.00 ($13.50 for foreign mailing). No additional postage is required for mailing within the United States, its possessions, Canada, Mexico, and all Central and South American countries except Argentina, Brazil, British Honduras, French Guiana, Guyana and Surinam. For shipment to all other foreign countries include additional postage as quoted for each periodical or subscription service.

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

☐ Remittance Enclosed. (Make checks payable to Superintendent of Documents)
☐ Charge to my Deposit Account No. ____________

Mail order form to:
Superintendent of Documents,
Government Printing Office,
Washington, D.C. 20402

GPO 848-855

GPO 837-443

United States Department of the Interior
Bureau of Reclamation, Code D-140
P.O. Box 25007, Denver Federal Center
Denver, CO 80225-0007

U.S.MAIL

Postage and Fees Paid
Department of the Interior
Int. 420
3rd Class Bulk Rate